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10/597,739	08/04/2006	Ali S. Sadri	P17140/1020.P17140	5587

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EXAMINER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

	Application No.	Applicant(s)
	10/597,739	SADRI ET AL.
Office Action Summary	Examiner	Art Unit	
	ADNAN BAIG	2461	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _11 November 2009_.

2a)☒ This action is FINAL.　　　2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1,2,4,5,7,10-12,14,15 and 17_ is/are pending in the application.

　　4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-2, 4-5, 7, 10-12, 14-15, and 17_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

　　Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

　　Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

　　a)☐ All　b)☐ Some * c)☐ None of:

　　　1.☐ Certified copies of the priority documents have been received.

　　　2.☐ Certified copies of the priority documents have been received in Application No. _____.

　　　3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

　　* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

DETAILED ACTION

Response to Arguments

1.   Applicant's arguments with respect to claims 1-2, 4-5, 7, 10-12, 14-15 and 17

have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

3.   Claims 1-2, 4-5, 7, 10-12, 14-15 and 17 are rejected under 35 U.S.C. 103(a) as

being unpatentable over Ketchum et al. US (2003/0185310) in view of Gore et al. US

(2006/0034163) and further in view of Kim (US 2006/0159160).

Regarding Claim 1, Ketchum discloses a method, comprising:

estimating a channel impulse response matrix, **(see Para [0080-0081])**

estimating at least one channel characteristic for said channel, **(see Para [0112]**

& [0081] i.e., (channel impulse response is estimated i.e., characteristic)

creating a crosstalk suppression filter matrix based on said channel impulse response

matrix, **(see Para [0007] Lines 3-11 & Fig. 1 which illustrates the impulse response**

for the received symbol vector r(n) wherein a noise vector Z(n) is processed at

the receiver, and is transmitted through a suppression filter 170).

filtering a plurality of data streams received over a channel for a multiple input multiple

output system (**see Fig. 1 & Para [0031]**) to reduce far end cross talk between said

data streams using said crosstalk suppression filter matrix (**see Fig. 1 item 170**) to form

filtered data streams **(see Para [0007] see Lines 7-18 & Para [0034]).**

said filtered data streams having substantially similar impulse responses, **(Referring to**

Fig. 1, Ketchum illustrates a plurality of data streams by vector r(n) [0031], where

r(n) is filtered through filter 172. Ketchum teaches a corresponding equal

matched filter for each individual set of plurality data streams which outputs

equal impulse responses for each data stream that is filtered, [0040-0043]).

equalizing said filtered data streams **(see Para [0007], lines 7-15)**

Ketchum does not disclose wherein said estimating comprises: approximating a plurality

of channel impulse response values based on said channel characteristic, and creating

said channel impulse response matrix using said channel impulse response values,

however the limitations would be rendered obvious in view of the teachings of Gore et

al. US (2006/0034163)

Referring to Fig. 8B, Gore illustrates generating a channel impulse response matrix in channel estimator 684y by matrix multiply unit 822. A composite MISO channel estimator 820 obtains a set of received pilot symbols for each receive antenna and training vector and performs a P-point IFFT on the set to obtain a corresponding composite MISO channel impulse response estimate (*i.e., impulse response is a characteristic of the channel*). A matrix multiplying unite 822 receives the R·M composite MISO channel impulse response estimates for the R receive antennas and M training vectors, multiplies these R·M sets with the matrix $\underline{U}$^-1 for each delay value, and provides the R·T least squares impulse response estimates for the R·T SISO channels of the MIMO channel. FFT unit 826 provides the final channel response estimates (*i.e., approximated channel impulse response values*) to RX spatial processor 660y, which uses these channel estimates for spatial processing of the received data symbols to obtain detected symbols, which are estimates of the transmitted data symbols **see Para [0129-0130] & [0073-0074]**)

Referring to (**Para [0024-0028] & [0041-0048]**), Gore illustrates generating a "2x2" channel impulse response matrix $\underline{H}$.

Gore teaches in a multi-antenna system which supports both MIMO and MISO receivers, different channel estimates are required which have different requirements for a pilot transmission. The pilot transmission should be such that both MISO and MIMO receivers can obtain channel estimates of sufficient quality, (**see Para [0007]**)

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention for estimating a channel impulse response matrix as taught by Ketchum who discloses estimating at least one channel characteristic for said channel, by implementing the teachings of Gore who discloses generating a channel impulse response matrix by estimating at least one characteristic for a channel, approximating a plurality of channel impulse response values based on said channel characteristic, and creating said channel impulse response matrix using said channel impulse response values, because the teaching lies in Gore to efficiently transmit a pilot in a multi-antenna system for obtaining estimates of sufficient quality.

The combination of Ketchum in view of Gore do not disclose equalizing said filtered data streams using a plurality of equalizers each having substantially similar equalization parameters, wherein the number of equalizers corresponds to the number of filtered data streams, however the limitations would be rendered obvious in view of the teachings of Kim et al. (US 2006/0159160).

Referring to **Fig. 2B**, Kim illustrates a plurality of equalizer banks from Bank 0 through Bank "M-1", each containing a filter for each receive antenna. The receive antenna receives and equalizes transmit signals (**data streams**) corresponding from each transmit antenna (**see Fig. 1B**) in a MIMO system, (**See Para [0041] & [0046]**).

Kim discloses the number of equalizer banks corresponds to the number of data

streams from the M transmit antennas 114 of Fig. 1B, see **Para [0049-0053].**

Kim discloses the plurality of equalizers banks from Bank 0 through Bank "M-1" shown

in Fig. 2B, have substantially similar equalization parameters (**i.e., filter coefficients**)

because they all calculate (**see fig. 3, step 312**) their respective filter coefficients (**Fig.**

2B, Filter coefficient 252) based on a computed channel coefficient and noise

covariance to determine their respective filter coefficients, (**see Para [0054]**).

Kim teaches multiple transmit and receive antennas (i.e., MIMO) are effective in

performance, peak throughput, and can provide diversity against deleterious path

effects (i.e., multi-path), (**see Para [0006] lines 16-31 & [0007-0008]**).

Kim teaches there is a need for linear space time equalizing in a MIMO CDMA system

by reusing spreading codes in different transmit antennas, (**see Para [0010]**)

Therefore it would have been obvious to one of ordinary skill in the art at the time of the

invention to include a plurality of equalizers having substantially similar equalization

parameters to equalize data streams, wherein the number of equalizers corresponds to

the number of data streams at taught by Kim, for a plurality of filtered data streams from

a crosstalk suppression filter matrix based on estimating a channel impulse response

matrix as taught by the combination of Ketchum in view of Gore, because the teaching

lies in Kim that equalizing data in a MIMO system can be effective in performance from multi-path.

Regarding Claim 2, the combination of Ketchum in view of Gore, and further in view of Kim disclose, the method of claim 1, wherein said channel impulse response matrix and said crosstalk suppression filter matrix have a substantially similar structure and matrix dimension, **[0042] see lines 1-7 (Ketchum describes the filter as in claim 1, matched to the impulse response in the equivalent channel).**
(In paragraph [0044] Ketchum discloses a formula that shows that the matrices of said channel impulse response and suppression filter are equal. Paragraphs [0045-0048] discuss the properties of said channel impulse response and suppression filter).

Regarding Claim 4, the combination of Ketchum in view Gore, and further in view of Kim disclose, the method of claim 1, wherein said creating comprises:
transposing said channel impulse response matrix, **(Ketchum, [0042])**

substituting each element of said transposed channel impulse response matrix with its minor element; **(Substituting each element of said CIR matrix with its minor element is interpreted as convolution in the claim with respect to the applicant's specification. The paragraph teaches convolution being performed on said transposed channel impulse response matrix, Ketchum, [0114]).**

determining a sign for each minor element, **(Determining a sign for each minor element is interpreted as convolution values in the claim with respect to the applicant's specifications. The paragraphs cited, determine the order for the convolution values or "minor element" based on the values sign, Ketchum see Para ([0126] & [0127 lines 1-5]).**

Regarding Claim 5, the combination of Ketchum in view of Gore, and further in view of Kim, disclose the method of claim 1, wherein each data stream comprises an inter-symbol interference signal, **(Ketchum, see Para [0036])**

Regarding Claim 7, Ketchum discloses a multiple input multiple output system, comprising:

 a communications medium; a plurality of transmitters to connect to said communications medium, with each transmitter to transmit a data stream over said communications medium using a communications channel; a plurality of receivers to connect to said communications medium, said plurality of receivers to receive said data streams from said communications channel, **[0007] (Ketchum illustrates a MIMO system in Fig. 3 where section 300 illustrates the plurality of transmitters and receivers connected to communications medium 310).**

a crosstalk filtering module to connect to said plurality of receivers, said crosstalk

filtering module to filter said data streams **(see Para [0007] see Lines 7-18)** to reduce

far end crosstalk noise incurred by said data streams during said transmission to form

filtered data streams, **(Referring to Fig. 1 section 170, Ketchum illustrates a**

crosstalk filtering module connected to the receivers of said MIMO system [0034]

see Lines 1-9).

said filtered data streams having substantially similar equal impulse responses,

(Referring to Fig. 1, Ketchum illustrates a plurality of data streams by vector r(n)

[0031], where r(n) is filtered through filter 172. Ketchum teaches a corresponding

equal matched filter for each individual set of plurality data streams which

outputs equal impulse responses for each data stream that is filtered, [0040-

0043]).

A channel estimator to connect to said receivers, said channel estimator to estimate at

least one channel characteristic, and create a channel impulse response matrix, **(see**

Para [0080-0081] & [0112] *i.e., channel impulse response is estimated,*

characteristic)

Ketchum does not disclose a channel estimator to approximate a plurality of channel

impulse response values based on said channel characteristic, and create a channel

impulse response matrix using said channel impulse response values, however the

limitations would be rendered obvious in view of the teachings of Gore et al. US

(2006/0034163)

Referring to Fig. 8B, Gore illustrates generating a channel impulse response matrix in

channel estimator 684y by matrix multiply unit 822. A composite MISO channel

estimator 820 obtains a set of received pilot symbols for each receive antenna and

training vector and performs a P-point IFFT on the set to obtain a corresponding

composite MISO channel impulse response estimate (*i.e., impulse response is a

characteristic of the channel*). A matrix multiplying unite 822 receives the R·M

composite MISO channel impulse response estimates for the R receive antennas and M

training vectors, multiplies these R·M sets with the matrix $\underline{U}$^-1 for each delay value, and

provides the R·T least squares impulse response estimates for the R·T SISO channels

of the MIMO channel. FFT unit 826 provides the final channel response estimates (*i.e.,

approximated channel impulse response values*) to RX spatial processor 660y,

which uses these channel estimates for spatial processing of the received data symbols

to obtain detected symbols, which are estimates of the transmitted data symbols **see**

Para [0129-0130] & [0073-0074])

Referring to (**Para [0024-0028] & [0041-0048]**), Gore illustrates generating a "2x2"

channel impulse response matrix $\underline{H}$.

Gore teaches in a multi-antenna system which supports both MIMO and MISO receivers, different channel estimates are required which have different requirements for a pilot transmission. The pilot transmission should be such that both MISO and MIMO receivers can obtain channel estimates of sufficient quality, **(see Para [0007])**

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention for creating a channel impulse response matrix as taught by Ketchum who discloses estimating at least one channel characteristic for said channel, by implementing the teachings of Gore who discloses generating a channel impulse response matrix by estimating at least one characteristic for a channel, approximating a plurality of channel impulse response values based on said channel characteristic, and creating a channel impulse response matrix using said channel impulse response values, because the teaching lies in Gore to efficiently transmit a pilot in a multi-antenna system for obtaining estimates of sufficient quality.

The combination of Ketchum in view of Gore do not disclose a plurality of equalizers to connect to said crosstalk filtering module, said plurality of equalizers each having substantially similar equalization parameters to equalize said filtered data streams, wherein the number of equalizers corresponds to the number of filtered data streams, however the limitation would be rendered obvious in view of the teachings of Kim et al. (US 2006/0159160).

Referring to **Fig. 2B**, Kim illustrates a plurality of equalizer banks from Bank 0 through

Bank "M-1", each containing a filter for each receive antenna. The receive antenna

receives and equalizes transmit signals **(data streams)** corresponding from each

transmit antenna **(see Fig. 1B**) in a MIMO system, **(See Para [0041] & [0046]).**

Kim discloses the number of equalizer banks corresponds to the number of data

streams from the M transmit antennas 114 of Fig. 1B, see **Para [0049-0053].**

Kim discloses the plurality of equalizers banks from Bank 0 through Bank "M-1" shown

in Fig. 2B, have substantially similar equalization parameters **(i.e., filter coefficients**)

because they all calculate **(see fig. 3, step 312**) their respective filter coefficients **(Fig.**

2B, Filter coefficient 252) based on a computed channel coefficient and noise

covariance to determine their respective filter coefficients, **(see Para [0054]**).

Kim teaches multiple transmit and receive antennas (i.e., MIMO) are effective in

performance, peak throughput, and can provide diversity against deleterious path

effects (i.e., multi-path), **(see Para [0006] lines 16-31 & [0007-0008]**).

Kim teaches there is a need for linear space time equalizing in a MIMO CDMA system

by reusing spreading codes in different transmit antennas, **(see Para [0010]**)

Therefore it would have been obvious to one of ordinary skill in the art at the time of the

invention to include a plurality of equalizers having substantially similar equalization

parameters to equalize data streams, wherein the number of equalizers corresponds to

the number of data streams at taught by Kim, for a plurality of filtered data streams from

a crosstalk suppression filter matrix based on estimating a channel impulse response

matrix as taught by the combination of Ketchum in view of Gore, in order to connect the

plurality of equalizers to a crosstalk filtering module because the teaching lies in Kim

that equalizing data in a MIMO system can be effective in performance from multi-path.

Regarding Claim 10, the combination of Ketchum in view of Gore, and further in view of

Kim disclose the multiple input multiple output system of claim 7, wherein said crosstalk

filtering module comprises:

a channel impulse response matrix generator to generate a channel impulse response

matrix, **[0040] (Referring to Fig.1, TX and RX MIMO processors which generate the**

channel impulse response matrix in the MIMO communication system as

illustrated in Fig. 1).

(Paragraph [0112] discloses that the RX MIMO processor transmits or generates

the estimated channel impulse response).

a crosstalk suppression filter matrix generator to generate a crosstalk suppression filter

matrix using said channel impulse response matrix; **(see Para [0034] lines 1-6)**

a filter to filter said data streams using said crosstalk suppression filter matrix, **(see**

Para [0007] lines 7-18)

Regarding Claim 11, Kethum discloses an apparatus, comprising:

a plurality of receivers to receive a plurality of data streams transmitted over a

communications channel, **[0007] (Fig. 1 and Fig. 3) (Ketchum illustrates a MIMO**

system in Fig. 3 where section 300 illustrates the plurality of transmitters and

receivers connected to communications medium 310).

a crosstalk filtering module to connect to said plurality of receivers, said crosstalk

filtering module to filter said data streams to reduce far end crosstalk noise incurred by

said data streams during said transmission to form filtered data streams, **(Referring to**

Fig. 1, section 170 illustrates a crosstalk filtering module connecting to the

receivers of said MIMO system). [0034] see Lines 1-9.

said filtered data streams having substantially similar equal impulse responses,

(Referring to Fig. 1, Ketchum illustrates a plurality of data streams by vector r(n)

[0031], where r(n) is filtered through filter 172. Ketchum teaches a corresponding

equal matched filter for each individual set of plurality data streams which

outputs equal impulse responses for each data stream that is filtered, [0040-

0043]).

A channel estimator to connect to said receivers, said channel estimator to estimate at

least one channel characteristic, and create a channel impulse response matrix, **(see**

Para [0080-0081] & [0112] *i.e., channel impulse response is estimated,*

characteristic)

Ketchum does not disclose a channel estimator to approximate a plurality of channel

impulse response values based on said channel characteristic, and create a channel

impulse response matrix using said channel impulse response values, however the

limitations would be rendered obvious in view of the teachings of Gore et al. US

(2006/0034163)

Referring to Fig. 8B, Gore illustrates generating a channel impulse response matrix in

channel estimator 684y by matrix multiply unit 822. A composite MISO channel

estimator 820 obtains a set of received pilot symbols for each receive antenna and

training vector and performs a P-point IFFT on the set to obtain a corresponding

composite MISO channel impulse response estimate (*i.e., impulse response is a*

characteristic of the channel). A matrix multiplying unite 822 receives the R·M

composite MISO channel impulse response estimates for the R receive antennas and M

training vectors, multiplies these R·M sets with the matrix $\underline{U}$^-1 for each delay value, and

provides the R·T least squares impulse response estimates for the R·T SISO channels

of the MIMO channel. FFT unit 826 provides the final channel response estimates (*i.e.,*

approximated channel impulse response values) to RX spatial processor 660y,

which uses these channel estimates for spatial processing of the received data symbols

to obtain detected symbols, which are estimates of the transmitted data symbols **see**
Para [0129-0130] & [0073-0074])

Referring to (**Para [0024-0028] & [0041-0048]**), Gore illustrates generating a "2x2"
channel impulse response matrix $\underline{H}$.

Gore teaches in a multi-antenna system which supports both MIMO and MISO
receivers, different channel estimates are required which have different requirements for
a pilot transmission. The pilot transmission should be such that both MISO and MIMO
receivers can obtain channel estimates of sufficient quality, (**see Para [0007]**)

Therefore it would have been obvious to one of ordinary skill in the art at the time of the
invention for creating a channel impulse response matrix as taught by Ketchum who
discloses estimating at least one channel characteristic for said channel, by
implementing the teachings of Gore who discloses generating a channel impulse
response matrix by estimating at least one characteristic for a channel, approximating a
plurality of channel impulse response values based on said channel characteristic, and
creating a channel impulse response matrix using said channel impulse response
values, because the teaching lies in Gore to efficiently transmit a pilot in a multi-antenna
system for obtaining estimates of sufficient quality.

The combination of Ketchum in view of Gore do not disclose a plurality of equalizers to connect to said crosstalk filtering module, said plurality of equalizers each having substantially similar equalization parameters to equalize said filtered data streams, wherein the number of equalizers corresponds to the number of filtered data streams, however the limitation would be rendered obvious in view of the teachings of Kim et al. (US 2006/0159160).

Referring to **Fig. 2B**, Kim illustrates a plurality of equalizer banks from Bank 0 through Bank "M-1", each containing a filter for each receive antenna. The receive antenna receives and equalizes transmit signals **(data streams)** corresponding from each transmit antenna **(see Fig. 1B)** in a MIMO system, **(See Para [0041] & [0046])**.

Kim discloses the number of equalizer banks corresponds to the number of data streams from the M transmit antennas 114 of Fig. 1B, see **Para [0049-0053].**

Kim discloses the plurality of equalizers banks from Bank 0 through Bank "M-1" shown in Fig. 2B, have substantially similar equalization parameters **(i.e., filter coefficients)** because they all calculate **(see fig. 3, step 312)** their respective filter coefficients **(Fig. 2B, Filter coefficient 252)** based on a computed channel coefficient and noise covariance to determine their respective filter coefficients, **(see Para [0054])**.

Kim teaches multiple transmit and receive antennas (i.e., MIMO) are effective in

performance, peak throughput, and can provide diversity against deleterious path

effects (i.e., multi-path), (**see Para [0006] lines 16-31 & [0007-0008]**).

Kim teaches there is a need for linear space time equalizing in a MIMO CDMA system

by reusing spreading codes in different transmit antennas, (**see Para [0010]**)

Therefore it would have been obvious to one of ordinary skill in the art at the time of the

invention to include a plurality of equalizers having substantially similar equalization

parameters to equalize data streams, wherein the number of equalizers corresponds to

the number of data streams at taught by Kim, for a plurality of filtered data streams from

a crosstalk suppression filter matrix based on estimating a channel impulse response

matrix as taught by the combination of Ketchum in view of Gore, in order to connect the

plurality of equalizers to a crosstalk filtering module because the teaching lies in Kim

that equalizing data in a MIMO system can be effective in performance from multi-path.

Regarding Claim 12, the combination of Ketchum in view of Gore, and further in view of

Kim disclose the apparatus of claim 11, wherein said crosstalk filtering module

comprises:

a channel impulse response matrix generator to generate a channel impulse response

matrix,(**Ketchum, [0040] Referring to Fig. 1, TX and RX MIMO processors generate

the channel impulse response matrix in the MIMO communication system.**

Paragraph [0112] discloses that the RX MIMO processor transmits or generates

the estimated channel impulse response).

a crosstalk suppression filter matrix generator to generate a crosstalk suppression filter

matrix using said channel impulse response matrix (Ketchum, **see Para [0034] see**

lines 1-6)

a filter to filter said data streams using said crosstalk suppression filter matrix,

(Ketchum, see Para [0007] lines 7-18)

Regarding Claim 14, the combination of Ketchum in view of Gore, and further in view of

Kim disclose the apparatus of claim 11, wherein said channel impulse matrix generator

is to connect to said channel estimator, and said channel impulse matrix generator is to

use said at least one channel characteristic for said channel to generate said channel

impulse matrix, **(the channel estimator sends or generates an estimated channel**

impulse response matrix, Ketchum Para [0112] lines 1-5).

Regarding Claim 15, Ketchum discloses an article of manufacture comprising:

a storage medium; said storage medium including stored instructions that, when

executed by a processor **(see Para [0192-0193])**, result in

estimating a channel impulse response matrix, **(see Para [0080-0081])**

estimating at least one channel characteristic for a channel, **(see Para [0112]**

& [0081] i.e., (channel impulse response is estimated i.e., characteristic)

creating a crosstalk suppression filter matrix based on said channel impulse response

matrix, **[0007] see Lines 3-11, (Fig. 1 illustrates the impulse response for the**

received symbol vector r(n) wherein a noise vector Z(n) which is processed at the

receiver, and is transmitted through a suppression filter 170).

filtering a plurality of data streams received over a channel for a multiple input multiple

output system to reduce far end cross talk between said data streams using said

crosstalk suppression filter matrix **(see Fig. 1 item 170)** to form filtered data streams,

(see Para [0007] Lines 13-18).

said filtered data streams having substantially similar equal impulse responses,

(Referring to Fig. 1, Ketchum illustrates a plurality of data streams by vector r(n)

[0031], where r(n) is filtered through filter 172. Ketchum teaches a corresponding

equal matched filter for each individual set of plurality data streams which

outputs equal impulse responses for each data stream that is filtered, [0040-

0043]).

equalizing said filtered data streams **([0007] see lines 7-15)**

Ketchum does not disclose wherein said estimating comprises: approximating a plurality

of channel impulse response values based on said channel characteristic, and creating

said channel impulse response matrix using said channel impulse response values,

however the limitations would be rendered obvious in view of the teachings of Gore et

al. US (2006/0034163)

Referring to Fig. 8B, Gore illustrates generating a channel impulse response matrix in

channel estimator 684y by matrix multiply unit 822. A composite MISO channel

estimator 820 obtains a set of received pilot symbols for each receive antenna and

training vector and performs a P-point IFFT on the set to obtain a corresponding

composite MISO channel impulse response estimate (*i.e., impulse response is a*

characteristic of the channel). A matrix multiplying unite 822 receives the R·M

composite MISO channel impulse response estimates for the R receive antennas and M

training vectors, multiplies these R·M sets with the matrix $\underline{U}$^-1 for each delay value, and

provides the R·T least squares impulse response estimates for the R·T SISO channels

of the MIMO channel. FFT unit 826 provides the final channel response estimates (*i.e.,*

approximated channel impulse response values) to RX spatial processor 660y,

which uses these channel estimates for spatial processing of the received data symbols

to obtain detected symbols, which are estimates of the transmitted data symbols **see**

Para [0129-0130] & [0073-0074])

Referring to **(Para [0024-0028] & [0041-0048])**, Gore illustrates generating a "2x2"

channel impulse response matrix $\underline{H}$.

Gore teaches in a multi-antenna system which supports both MIMO and MISO

receivers, different channel estimates are required which have different requirements for

a pilot transmission. The pilot transmission should be such that both MISO and MIMO

receivers can obtain channel estimates of sufficient quality, **(see Para [0007])**

Therefore it would have been obvious to one of ordinary skill in the art at the time of the

invention for estimating a channel impulse response matrix as taught by Ketchum who

discloses estimating at least one channel characteristic for said channel, by

implementing the teachings of Gore who discloses generating a channel impulse

response matrix by estimating at least one characteristic for a channel, approximating a

plurality of channel impulse response values based on said channel characteristic, and

creating said channel impulse response matrix using said channel impulse response

values, because the teaching lies in Gore to efficiently transmit a pilot in a multi-antenna

system for obtaining estimates of sufficient quality.

The combination of Ketchum in view of Gore do not disclose equalizing said filtered

data streams using a plurality of equalizers have [*sic*] substantially similar equalization

parameters, wherein the number of equalizers corresponds to the number of filtered

data streams, however the limitation would be rendered obvious in view of the teachings

of Kim et al. (US 2006/0159160).

Referring to **Fig. 2B**, Kim illustrates a plurality of equalizer banks from Bank 0 through

Bank "M-1", each containing a filter for each receive antenna. The receive antenna

receives and equalizes transmit signals (**data streams**) corresponding from each

transmit antenna (**see Fig. 1B**) in a MIMO system, (**See Para [0041] & [0046]**).

Kim discloses the number of equalizer banks corresponds to the number of data

streams from the M transmit antennas 114 of Fig. 1B, see **Para [0049-0053].**

Kim discloses the plurality of equalizers banks from Bank 0 through Bank "M-1" shown

in Fig. 2B, have substantially similar equalization parameters (**i.e., filter coefficients**)

because they all calculate (**see fig. 3, step 312**) their respective filter coefficients (**Fig.

2B, Filter coefficient 252**) based on a computed channel coefficient and noise

covariance to determine their respective filter coefficients, (**see Para [0054]**).

Kim teaches multiple transmit and receive antennas (i.e., MIMO) are effective in

performance, peak throughput, and can provide diversity against deleterious path

effects (i.e., multi-path), (**see Para [0006] lines 16-31 & [0007-0008]**).

Kim teaches there is a need for linear space time equalizing in a MIMO CDMA system

by reusing spreading codes in different transmit antennas, **(see Para [0010])**

Therefore it would have been obvious to one of ordinary skill in the art at the time of the

invention to include a plurality of equalizers having substantially similar equalization

parameters to equalize data streams, wherein the number of equalizers corresponds to

the number of data streams at taught by Kim, for a plurality of filtered data streams from

a crosstalk suppression filter matrix based on estimating a channel impulse response

matrix as taught by the combination of Ketchum in view of Gore, because the teaching

lies in Kim that equalizing data in a MIMO system can be effective in performance from

multi-path.

Regarding Claim 17, the combination of Ketchum in view of Kim disclose the article of

claim 15, wherein the stored instructions, when executed by a processor, further result

in said creating by transposing said channel impulse response matrix, **(Ketchum, see**

Para [0042]).

substituting each element of said transposed channel impulse response matrix with its

minor element, **(Substituting each element of said CIR matrix with its minor**

element is interpreted as convolution in the claim with respect to the applicant's

specification. The paragraph teaches convolution being performed on said

transposed channel impulse response matrix, Ketchum, [0114]).

determining a sign for each minor element, **(Ketchum, see Para [0126-0127 lines 1-5].**

Determining a sign for each minor element is interpreted as convolution values in

the claim with respect to the applicant's specifications. The paragraphs cited,

determine the order for the convolution values or "minor element" based on the

values sign).

Conclusion

4.   Applicant's amendment necessitated the new ground(s) of rejection presented in

this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37

CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later

than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to ADNAN BAIG whose telephone number is (571) 270-

7511. The examiner can normally be reached on Mon-Fri 7:30m-5:00pm eastern Every

other Fri off.

    If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Huy Vu can be reached on 571-272-3155. The fax phone number for the

organization where this application or proceeding is assigned is 571-273-8300.

    Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ADNAN BAIG/
Examiner, Art Unit 2461

/Huy D Vu/

Supervisory Patent Examiner, Art Unit 2461